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Fremont Lake, Sublette County, Wyoming

National Eutrophication Survey, Corvallis, Oreg

Prepared for

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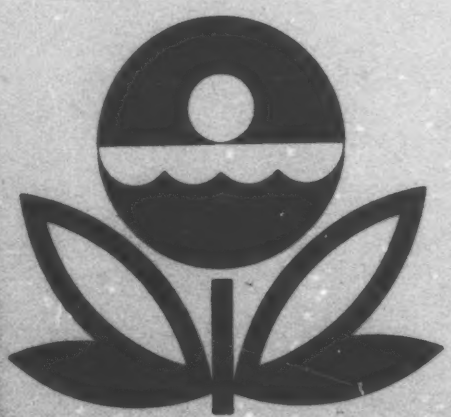
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT
ON
FREMONT LAKE
SUBLETTE COUNTY
WYOMING
EPA REGION VIII
WORKING PAPER No. 886

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

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REPORT
ON
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SUBLETTE COUNTY
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WITH THE COOPERATION OF THE
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
AND THE
WYOMING NATIONAL GUARD
AUGUST, 1977

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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CONTENTS

	Page
Foreword	ii
List of Wyoming Lakes and Reservoirs	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	3
III. Lake Water Quality Summary	4
IV. Nutrient Loadings	7
V. Literature Reviewed	12
VI. Appendices	13

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wyoming Department of Environmental Quality for professional involvement, to the Wyoming National Guard for conducting the tributary sampling phase of the Survey, and to those Wyoming wastewater treatment plant operators who voluntarily provided effluent samples.

The staff of the Water Quality Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

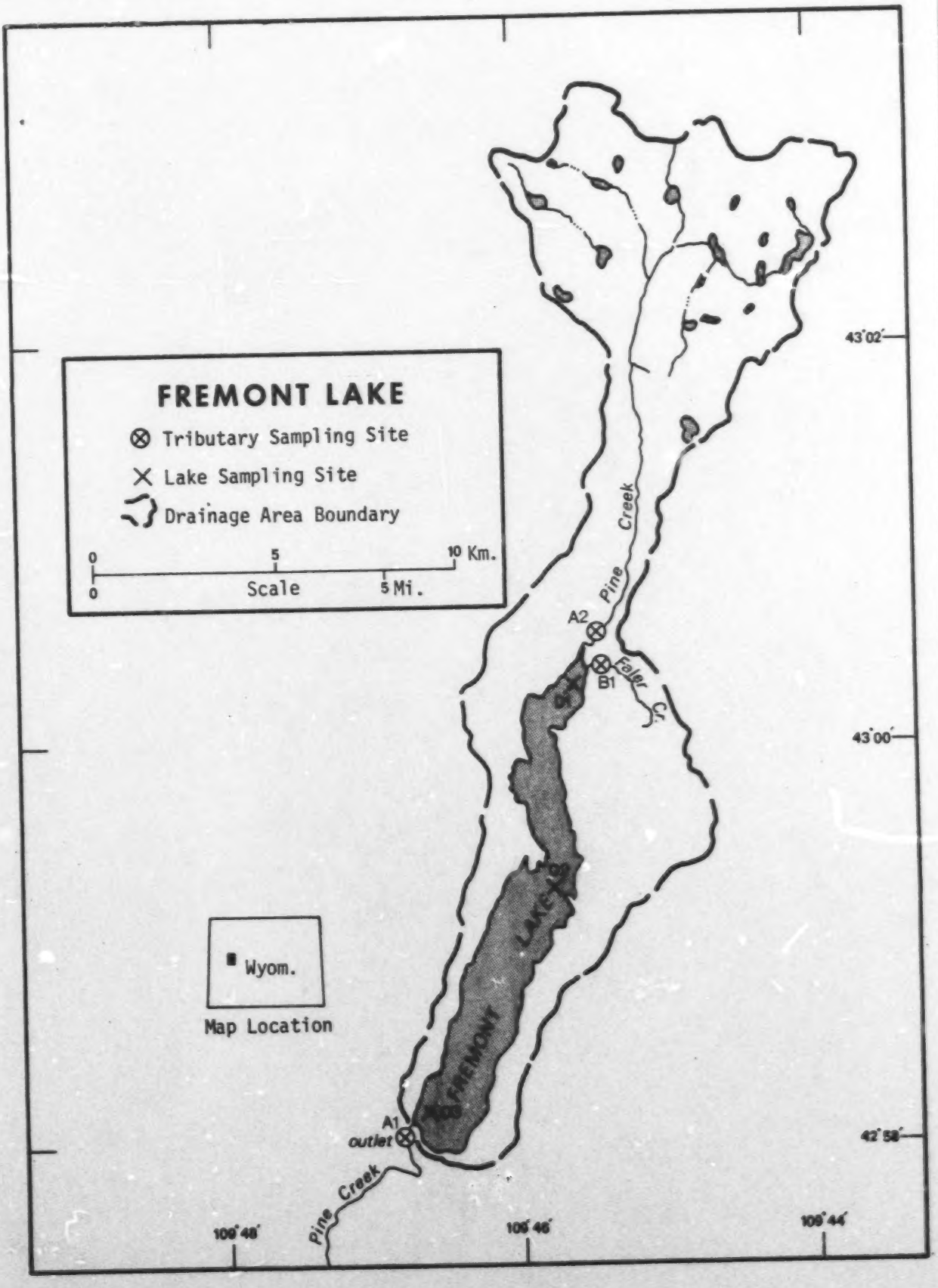
Brigadier General James L. Spence, The Adjutant General of Wyoming, and Project Officer Colonel Donald L. Boyer, who directed the volunteer efforts of the Wyoming National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of Wyoming

NAME	COUNTY
Big Sandy	Sublette, Sweetwater
Boulder	Sublette
Boysen	Fremont
De Smet	Johnson
Flaming Gorge	Sweetwater, WY; Daggett, UT
Fremont	Sublette
Glendo	Converse, Platte
Keyhole	Crook
Ocean	Fremont
Seminoe	Carbon
Soda	Sublette
Viva Naughton	Lincoln
Woodruff Narrows	Uinta
Yellowtail	Bighorn, WY; Bighorn, Carbon, MT


FREMONT LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0
5
10 Km.
0
Scale
5 Mi.
Wyom.
Map Location
Pine Creek
A2
B1
Falter Cr.
43°02'
43°00'
42°58'
FREMONT LAKE
A1
outlet
Pine Creek
109°48'
109°46'
109°44'

FREMONT LAKE

STORET NO. 5606

I. CONCLUSIONS

A. Trophic Condition:

Survey data and reports (McKnight, 1971; Miller, 1972) indicate that Fremont Lake is oligotrophic. It ranked second in overall trophic quality when the 14 Wyoming lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. None of the other water bodies had less median total phosphorus, none had less and four had the same median inorganic nitrogen, none had less and one had the same median dissolved orthophosphorus, two had less mean chlorophyll a, and none of the others had a greater mean Secchi disc transparency. No depression of dissolved oxygen occurred at depths as great as 51.8 meters.

B. Rate-Limiting Nutrient:

Because of significant nutrient changes in the samples during shipment from the field to the laboratory, the algal assay results are not considered representative of conditions in the lake at the times the samples were taken (08/28/75 and 10/17/75).

The lake data indicate phosphorus limitation both sampling times.

C. Nutrient Controllability:

1. Point sources--No known municipal or industrial wastewater treatment plants impacted Fremont Lake during the sampling

* See Appendix A.

year. Septic tanks serving lakeshore dwellings and recreational areas were estimated to have contributed 0.6% of the total phosphorus load to the lake during the sampling year, but a shoreline survey would be needed to determine the significance of those sources.

The present phosphorus loading of 0.12 $g/m^2/yr$ is less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic loading (see page 11), and every effort should be made to prevent any increase in phosphorus inputs to preserve the existing trophic quality of Fremont Lake.

2. Non-point sources--The phosphorus contributions of non-point sources, including direct precipitation, accounted for 99.4% of the total phosphorus load to the lake during the sampling year. Pine Creek added 61.0% of the total load, and the ungaged tributaries contributed an estimated 23.3%.

The phosphorus export rate of Pine Creek was 7 $kg/km^2/yr$ (see page 10). This rate was somewhat lower than that of an unimpacted tributary of nearby Boulder Lake (12 $kg/km^2/yr$)*.

* Working Paper No. 882.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 20.23 kilometers^2.
2. Mean depth: 24.4 meters.
3. Maximum depth: 185.3 meters.
4. Volume: 493.730 x 10^6 m^3.
5. Mean hydraulic retention time: 2.5 years.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Pine Creek	196.8	5.090
Minor tributaries & immediate drainage -	78.3	1.210
Totals	275.1	6.300**

2. Outlet -

Pine Creek	295.3***	6.300

C. Precipitation****:

1. Year of sampling: 25.7 centimeters.
2. Mean annual: 28.5 centimeters.

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† Table of metric equivalents--Appendix B.
†† Prior, 1974.
* For limits of accuracy, see Working Paper No. 175, "... Survey Methods, 1973-1976".
** Sum of inflows adjusted to equal outflow.
*** Includes area of lake.
**** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Fremont Lake was sampled two times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at three stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during both visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll *a* analysis. The maximum depths sampled were 51.8 meters at stations 1 and 2 and 30.5 meters at station 3.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR FREMONT LAKE
STORET CODE 5606

PARAMETER	1ST SAMPLING (8/28/75) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (10/17/75) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING 0 SITES RANGE	MEAN	MEDIAN
TEMP (C)	4.7 - 15.6	10.5	10.3	7.7 - 12.2	10.4	11.8	******	**********	
DISS OXY (MG/L)	7.6 - 9.6	8.4	8.4	8.4 - 9.0	8.5	8.4	******	**********	
CNDCTVY (MCROMO)	17. - 25.	21.	19.	1. - 1.	1.	1.	******	**********	
PH (STAND UNITS)	6.9 - 8.4	7.9	7.9	6.8 - 8.2	7.4	7.3	******	**********	
TOT ALK (MG/L)	12. - 22.	15.	13.	10. - 21.	15.	16.	******	**********	
TOT P (MG/L)	0.006 - 0.013	0.008	0.007	0.004 - 0.006	0.005	0.005	******	**********	
ORTHO P (MG/L)	0.002 - 0.002	0.002	0.002	0.002 - 0.006	0.002	0.002	******	**********	
NO2+NO3 (MG/L)	0.020 - 0.030	0.021	0.020	0.020 - 0.030	0.021	0.020	******	**********	
AMMONIA (MG/L)	0.020 - 0.050	0.023	0.020	0.020 - 0.020	0.020	0.020	******	**********	
KJEL N (MG/L)	0.200 - 0.500	0.259	0.200	0.200 - 0.200	0.200	0.200	******	**********	
INORG N (MG/L)	0.040 - 0.070	0.044	0.040	0.040 - 0.050	0.041	0.040	******	**********	
TOTAL N (MG/L)	0.220 - 0.520	0.279	0.220	0.220 - 0.230	0.221	0.220	******	**********	
CHLRPYL A (UG/L)	2.7 - 5.8	4.6	5.3	2.7 - 3.2	3.0	3.0	******	**********	
SECCHI (METERS)	9.1 - 15.2	11.3	9.4	15.2 - 15.2	15.2	15.2	******	**********	

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
08/28/75	1. Chlamydomonas (?) sp.	3,336
	2. Asterionella sp.	128
	3. Tabellaria sp.	86
	4. Rhizosolenia sp.	43
	5. Dinobryon sp.	43
	Total	3,636
10/17/75	1. Chlamydomonas (?) sp.	3,181
	2. Asterionella sp.	468
	3. Chrysophytan flagellates	281
	4. Tabellaria sp.	140
	5. Chroomonas (?) sp.	94
	Total	4,164

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
08/28/75	1	2.7
	2	5.8
	3	5.3
10/17/75	1	3.0
	2	3.2
	3	2.7

C. Limiting Nutrient Studies:

Because of significant nutrient changes in the samples during shipment from the field to the laboratory, the algal assay results are not considered representative of conditions in Fremont Lake at the times the samples were taken (08/28/75 and 10/17/75).

The lake data indicate phosphorus limitation both sampling times. The mean inorganic nitrogen to orthophosphorus ratios were 22 to 1 in August and 20 to 1 in October, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Wyoming National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff month of July when two samples were collected from the inlet tributary sites. Sampling was begun in October, 1974, and was completed in July, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wyoming District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads at station A-2, in $kg/km^2/year$, and multiplying by the ZZ area in km^2.

No known wastewater treatment plants impacted Fremont Lake during the sampling year.

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Pine Creek	1,440	61.0
b. Minor tributaries & immediate drainage (non-point load) -	550	23.3
c. Known municipal STP's - None	-	-
d. Septic tanks* -	15	0.6
e. Known industrial - None	-	-
f. Direct precipitation** -	355	15.1
Total	2,360	100.0

2. Outputs -

Lake outlet - Pine Creek 1,870

3. Net annual P accumulation - 490 kg.

* Estimate based on 24 lakeshore dwellings, four campgrounds, and one picnic area; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Pine Creek	144,675	64.4
b. Minor tributaries & immediate drainage (non-point load) -	57,550	25.6
c. Known municipal STP's - None	-	-
d. Septic tanks* -	570	0.3
e. Known industrial - None	-	-
f. Direct precipitation** -	21,840	9.7
Total	224,635	100.0

2. Outputs -

Lake outlet - Pine Creek 28,185

3. Net annual N accumulation - 196,450 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Pine Creek	7	735

E. Mean Nutrient Concentrations in Ungaged Stream:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Faler Creek	0.011	0.588

* Estimate based on 24 lakeshore dwellings, four campgrounds, and one picnic area; see Working Paper No. 175.
** See Working Paper No. 175.

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.12	0.02	11.1	9.7

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Fremont Lake:	
"Dangerous" (eutrophic loading)	0.60
"Permissible" (oligotrophic loading)	0.30

V. LITERATURE REVIEWED

Anonymous, 1963. The Fremont Canyon powerplant. U.S. Bur. Reclam., Denver, CO.

McKnight, Ron, 1971. Partial biological inventory and survey of Fremont Lake, Pinedale, Wyoming. Adm. Rept., Fish Divn., WY Game & Fish Comm., Cheyenne.

Miller, Don, 1972. Kokanee salmon in Fremont Lake. Admin. Rept., Fish Divn., WY Game & Fish Comm., Cheyenne.

Prior, Roy E., 1974. Personal Communication (lake morphometry). WY Dept. of Env. Qual., Cheyenne.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
5601	BIG SANDY RESERVOIR	0.087	0.060	487.667	4.383	8.800	0.020
5602	BOULDER LAKE	0.008	0.040	361.800	2.483	8.400	0.002
5603	BOYSEN RESERVOIR	0.037	0.140	465.923	6.264	14.400	0.014
5604	LAKE DE SMET	0.033	0.040	409.000	11.167	9.400	0.006
5605	FLAMING GORGE RESERVOIR	0.014	0.605	366.461	5.611	12.200	0.003
5606	FREMONT LAKE	0.006	0.040	-22.000	3.783	7.400	0.002
5607	GLENDO RESERVOIR	0.045	0.315	459.182	8.473	12.600	0.014
5608	KEY HOLE RESERVOIR	0.028	0.050	454.583	7.792	14.000	0.004
5609	OCEAN LAKE	0.043	0.040	478.333	7.500	8.600	0.004
5610	SEMINOLE RESERVOIR	0.030	0.130	447.000	2.536	11.000	0.007
5611	SODA LAKE	0.063	0.040	387.500	5.575	15.000	0.014
5612	VIVA NAUGHTON RESERVOIR	0.065	0.120	430.000	25.067	13.200	0.024
5613	WOODRUFF NARROWS RESERVO	0.069	0.105	470.000	12.950	13.200	0.019
5614	YELLOWTAIL RESERVOIR	0.026	0.310	364.500	5.410	10.000	0.017

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
5601	BIG SANDY RESERVOIR	0 (0)	54 (7)	0 (0)	77 (10)	77 (10)	8 (1)	216
5602	BOULDER LAKE	92 (12)	92 (11)	92 (12)	100 (13)	92 (12)	92 (12)	560
5603	BOYSEN RESERVOIR	46 (6)	23 (3)	23 (3)	46 (6)	8 (1)	42 (5)	188
5604	LAKE DE SMET	54 (7)	73 (9)	62 (8)	15 (2)	69 (9)	62 (8)	335
5605	FLAMING GORGE RESERVOIR	85 (11)	0 (0)	77 (10)	54 (7)	46 (6)	85 (11)	347
5606	FREMONT LAKE	100 (13)	73 (9)	100 (13)	85 (11)	100 (13)	100 (13)	558
5607	GLENDO RESERVOIR	31 (4)	8 (1)	31 (4)	23 (3)	38 (5)	42 (5)	173
5608	KEY HOLE RESERVOIR	69 (9)	62 (8)	38 (5)	31 (4)	15 (2)	69 (9)	284
5609	OCEAN LAKE	38 (5)	92 (11)	8 (1)	38 (5)	85 (11)	77 (10)	338
5610	SEMINOLE RESERVOIR	62 (8)	31 (4)	46 (6)	92 (12)	54 (7)	54 (7)	339
5611	SODA LAKE	23 (3)	92 (11)	69 (9)	62 (8)	0 (0)	31 (4)	277
5612	VIVA NAUGHTON RESERVOIR	15 (2)	38 (5)	54 (7)	0 (0)	27 (3)	0 (0)	134
5613	WOODRUFF NARROWS RESERVO	8 (1)	46 (6)	15 (2)	8 (1)	27 (3)	15 (2)	119
5614	YELLOWTAIL RESERVOIR	77 (10)	15 (2)	85 (11)	69 (9)	62 (8)	23 (3)	331

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	5602	BOULDER LAKE	560
2	5606	FREMONT LAKE	558
3	5605	FLAMING GORGE RESERVOIR	347
4	5610	SEMINOLE RESERVOIR	339
5	5609	OCEAN LAKE	338
6	5604	LAKE DE SMET	335
7	5614	YELLOWTAIL RESERVOIR	331
8	5608	KEY HOLE RESERVOIR	284
9	5611	SODA LAKE	277
10	5601	BIG SANDY RESERVOIR	216
11	5603	BOYSEN RESERVOIR	188
12	5607	GLENDO RESERVOIR	173
13	5612	VIVA NAUGHTON RESERVOIR	134
14	5613	WOODRUFF NARROWS RESERVO	119

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WYOMING 08/05/75

LAKE CODE 5606 FREMONT LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 295.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5606A1	295.3	0.65	0.71	0.71	0.99	4.53	25.77	26.90	7.65	3.68	1.78	1.05	0.79	6.30
5606A2	196.8	0.62	0.54	0.48	0.91	8.04	24.75	15.06	4.76	2.63	1.59	0.91	0.68	5.09
5606ZZ	98.4	0.113	0.085	0.085	0.170	1.557	4.814	2.832	0.991	0.566	0.283	0.170	0.142	0.987

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 295.3
SUM OF SUB-DRAINAGE AREAS = 295.3

TOTAL FLOW IN = 72.77
TOTAL FLOW OUT = 75.21

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5606A1	10	74	0.850	6	1.076				
	11	74	0.566	10	0.680				
	12	74	0.283	13	0.340				
	1	75	0.283	11	0.283				
	2	75	0.425						
	3	75	0.283	12	0.283				
	4	75	0.283	5	0.283				
	5	75	3.115	4	0.340	27	7.646		
	6	75	14.158	4	8.495	9	8.495		
	7	75	33.980	18	25.485	20	22.653		
	8	75	7.079	2	16.990				
	9	75	2.832						
5606A2	10	74	0.425	6	0.623				
	11	74	0.311	10	0.340				
	12	74	0.255	4	0.227				
	1	75	0.340	27	0.396				
	2	75	0.368	27	0.368				
	3	75	0.425	21	0.311				
	4	75	0.595	24	0.481				
	5	75	2.549						
	6	75	17.896						
	7	75	31.375	2	43.325	21	22.370		
	8	75	4.757						
	9	75	1.529						
5606ZZ	10	74	0.057						
	11	74	0.057						
	12	74	0.057						
	1	75	0.057						
	2	75	0.057						
	3	75	0.085						
	4	75	0.142						
	5	75	0.991						
	6	75	3.398						
	7	75	5.663						
	8	75	0.850						
	9	75	0.283						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/05

560601
43 01 10.0 109 46 43.0 3
FREMONT LAKE
56035 WYOMING

11EPALES 2111202
0999 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/08/28	08 20	0000	15.4	7.8	360	20	7.40	13	0.020K	0.200K	0.020K	0.002
	08 20	0005	15.4	8.0		19	7.90	12	0.020K	0.200K	0.020K	0.002K
	08 20	0035	10.3	9.6		19	8.00	13	0.020K	0.200K	0.020K	0.002K
	08 20	0075	5.5	8.8		18	7.50	13	0.020K	0.200K	0.020K	0.002K
	08 20	0120	4.9	8.4		17	7.20	15	0.050	0.200K	0.020	0.002K
	08 20	0170	4.7	8.4		17	6.90	17	0.020K	0.200K	0.020	0.002K
75/10/17	09 55	0000	12.2	8.8	600	1K	8.20	21	0.020K	0.200K	0.020K	0.002
	09 55	0005	12.2	8.4		1K	8.00	18	0.020K	0.200K	0.020K	0.002
	09 55	0025	12.2	8.4		1K	7.90	18	0.020K	0.200K	0.020K	0.002K
	09 55	0055	11.6	8.4		1K	7.70	17	0.020K	0.200K	0.020K	0.002
	09 55	0090	8.7	8.4		1K	7.50	16	0.020K	0.200K	0.020	0.006
	09 55	0130	7.8	8.6		1K	6.80	10K	0.020K	0.200K	0.020	0.002
	09 55	0170	7.7	8.4		1K	6.90	10K	0.020K	0.200K	0.030	0.004

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/08/28	08 20	0000	0.010	2.7	
	08 20	0005	0.009		
	08 20	0035	0.009		
	08 20	0075	0.006		
	08 20	0120	0.006		
	08 20	0170	0.006		
75/10/17	09 55	0000	0.005	3.0	
	09 55	0005	0.004		
	09 55	0025	0.004		
	09 55	0055	0.005		
	09 55	0090	0.006		
	09 55	0130	0.004		
	09 55	0170	0.005		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

560602
42 58 14.0 109 47 12.0 3
FREMONT LAKE
56035 WYOMING

- 23<

11FMALES 2111202
0999 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/08/28	09 00	0000	15.6	7.8	600	25	8.40	14	0.020K	0.200	0.020K	0.002K
	09 00	0005	15.3	8.0		25	8.20	16	0.020K	0.200	0.020K	0.002K
	09 00	0035	15.1	8.6		24	8.40	13	0.020K	0.300	0.020K	0.002K
	09 00	0070	6.9	8.8		19	7.90	21	0.020K	0.200	0.020K	0.002K
	09 00	0120	5.0	8.4		19	7.55	12	0.020K	0.300	0.030	0.002K
	09 00	0170	4.9	8.6		19	7.30	13	0.040	0.300	0.020	0.002K
75/10/17	10 30	0000	12.2	8.4	600	1K	7.70	10K	0.020K	0.200K	0.020K	0.002
	10 30	0005	12.2	8.4		1K	7.70	10	0.020K	0.200K	0.020K	0.002
	10 30	0025	12.1	8.4		1K	7.90	11	0.020K	0.200K	0.020K	0.002
	10 30	0060	11.0	9.0		1K	7.60	11	0.020K	0.200K	0.020K	0.002K
	10 30	0100	7.9	8.4		1K	7.35	13	0.020K	0.200K	0.020	0.002
	10 30	0135	7.7	8.4		1K	7.20	13	0.020K	0.200K	0.030	0.003
	10 30	0170	7.7	8.4		1K	7.10	15	0.020K	0.200K	0.030	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/08/28	09 00	0000	0.006	5.8	
	09 00	0005	0.006		
	09 00	0035	0.006		
	09 00	0070	0.006		
	09 00	0120	0.008		
	09 00	0170	0.006		
75/10/17	10 30	0000	0.006	3.2	
	10 30	0005	0.006		
	10 30	0025	0.005		
	10 30	0060	0.006		
	10 30	0100	0.004		
	10 30	0135	0.004		
	10 30	0170	0.004		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

560603
42 54 30.0 109 50 05.0 3
FREMONT LAKE
56035 WYOMING

11EPALES 2111202
0089 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/08/28	09 35	0000	15.4	7.8	372	25	8.30	22	0.020K	0.500	0.020K	0.002
	09 35	0005	15.4	7.6		25	8.10	14	0.020K	0.400	0.020K	0.002K
	09 35	0035	15.1	8.0		25	8.40	13	0.020K	0.400	0.020K	0.002K
	09 35	0062	8.3	9.2		20	8.15	13	0.020K	0.200K	0.020K	0.002K
	09 35	0085	5.6	8.6		19	7.90	14	0.020K	0.200K	0.020K	0.002K
75/10/17	11 00	0000	12.1	8.4	600	1K	7.30	15	0.020K	0.200K	0.020K	0.002
	11 00	0005	12.1	8.8		1K	7.20	19	0.020K	0.200K	0.020K	0.002
	11 00	0015	12.1	8.4		1K	7.25	18	0.020K	0.200K	0.020K	0.002K
	11 00	0040	12.0	8.6		1K	7.30	21	0.020K	0.200K	0.020K	0.002
	11 00	0070	8.7	8.4		1K	7.15	20	0.020K	0.200K	0.020K	0.004
	11 00	0100	8.1	8.4		1K	7.00	19	0.020K	0.200K	0.020	0.002

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/08/28	09 35	0000	0.013	5.3	
	09 35	0005	0.009		
	09 35	0035	0.009		
	09 35	0062	0.009		
	09 35	0085	0.007		
75/10/17	11 00	0000	0.006	2.7	
	11 00	0005	0.005		
	11 00	0015	0.005		
	11 00	0040	0.006		
	11 00	0070	0.006		
	11 00	0100	0.004		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/08/05

5606A1
42 53 55.0 109 50 20.0 4
PINE CREEK
56 7.5 S FREMONT LK
U/FREMONT LAKE 110691
BNK .5 MI S OF DAM SPILLWAY
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/04	10	55	0.008	0.100K	0.010	0.005K	0.005K
74/11/10	17	30	0.010	0.200	0.015	0.005K	0.010K
74/12/13	15	15	0.022	0.500	0.020	0.005K	0.010K
75/01/11	12	30	0.008	0.300	0.008	0.005K	0.010
75/03/12	16	00	0.005	0.150	0.005	0.005K	0.010K
75/04/05	17	00	0.005	0.250	0.015	0.005K	0.010K
75/05/04	15	15	0.030	0.400	0.045	0.005	0.010
75/05/27	15	20	0.020	0.100	0.020	0.005	0.020
75/06/04	17	10	0.050	0.250	0.010	0.005K	0.010K
75/06/09	09	30	0.010	0.050K	0.025	0.005K	0.010
75/07/18	14	00	0.010	0.100	0.015	0.005K	0.010K
75/07/20	11	05	0.010	0.150	0.015	0.005K	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

560691
43 01 25.0 109 46 20.0 4
FALER CREEK
56 7.5 N FREMONT LK
T/FREMONT LAKE 110691
AT XING W PINE CREEK CANYON TRAIL
11EPALES 2111204
0000 FEET DEPTH CLASS 00

- 28<

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/06	12 05		0.008	0.300	0.005	0.005K	0.005
74/11/10	15 00		0.016	0.200	0.015	0.005	0.010
74/12/04	11 00		0.016	1.000	0.015	0.010	0.010
75/06/04	17 20		0.015	0.350	0.020	0.010	0.010
75/07/02	08 30		0.015	0.250	0.025	0.010	0.020
75/07/21	17 00		0.010	1.350	0.065	0.005	0.010K

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/08/05

S606A2
43 01 50.0 109 46 10.0 4
PINE CREEK
56 7.5 N FREMONT LK
T/FREMONT LAKE 110691
.5 MI UPSTRM FROM FREMONT LAKE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

: 27<

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/10/06	12 25		0.048	0.400	0.025	0.005K	0.005K
74/11/10	14 00		0.072	0.200	0.020	0.005K	0.010K
74/12/04	11 00		0.088	0.300	0.010	0.005K	0.010K
75/01/27	16 00		0.128	0.800	0.016	0.005	0.010K
75/02/27	13 45		0.130	1.650	0.030	0.005K	0.010K
75/03/21	11 15		0.135	0.250	0.015	0.005	0.010K
75/04/24	11 40		0.125	2.200	0.040	0.005K	0.010K
75/07/02	08 20		0.050	0.600	0.020	0.005K	0.010
75/07/21	16 30		0.045	0.350	0.017	0.005K	0.010K

K VALUE KNOWN TO BE
LESS THAN INDICATED